MATERIAL STANDARDS FOR ARCHIVAL PRESERVATION

Physical Artifact Specifications for Century-Scale Documentation

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Standards Working Group

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ABSTRACT

The P-Series instruments are designed for physical permanence. This technical note establishes material specifications for paper, ink, binding, and storage to ensure 100-200 year artifact longevity. Context: Digital formats change. Software becomes obsolete. Cloud providers fail. Encryption breaks. Technology ages. Paper endures. The Standard Index Group position: Paper first, digital optional. This is not nostalgia. It is institutional rigour based on century-tested archival practices. Scope: This note covers:

- Paper specifications (weight, acidity, permanence rating)
- Ink specifications (pigment vs dye, archival quality)
- Binding mechanisms (durability, page addition protocols)
- Storage conditions (humidity, temperature, light exposure)
- Material sourcing (approved suppliers)
- Quality verification protocols

Standards Referenced:

- ISO 9706:1994 - Requirements for permanence of paper[1]
- ISO 11108:1996 - Archival paper requirements
- ANSI/NISO Z39.48 - Permanence of paper for publications

[1] ISO 9706:1994 Information and documentation - Paper for documents - Requirements for permanence. Specifies minimum requirements for paper used for documents for long-term conservation (hundreds of years).

PAPER SPECIFICATIONS

Minimum Standard: ISO 9706 Compliant

Weight:

160 GSM minimum (grams per square meter)

- Standard copy paper: 80 GSM (inadequate - too thin)
- Card stock: 200-300 GSM (excessive - binding issues)
- Target range: 160-200 GSM (optimal durability + flexibility)

Why 160 GSM:

- Sufficient opacity (no see-through)
- Handles repeated handling without tearing
- Pen/pencil annotations don't bleed through
- Archival storage compatible
- Three-ring binder compatible

Acidity (pH):

pH 7.0-8.5 (alkaline or neutral) Acid-free requirement: Paper with pH below 7.0 degrades rapidly (yellowing, brittleness within 50-100 years) Alkaline reserve: 2% calcium carbonate minimum

- Buffers against environmental acidity
- Extends longevity to 200+ years
- Protects against atmospheric pollutants

Testing: pH test strips available from archival suppliers

- Test each paper batch upon receipt
- Document pH in procurement records

Composition:

100% cotton fiber (preferred) or wood pulp with lignin removed Avoid:

- ☒ Groundwood pulp (high lignin content = rapid aging)
- ☒ Recycled paper without acid-free certification
- ☒ Newsprint-grade stock

Certified Sources:

- Mohawk Superfine (100% cotton, pH neutral)
- Neenah ENVIRONMENT (100% PCW, acid-free)
- Southworth 25% Cotton (archival grade)

Longevity Rating:

ISO 9706 certification = 200+ year permanence Look for:

- Infinity symbol (∞) on packaging

- "Archival Quality" certification
- "Acid-Free" statement
- ISO 9706 compliance mark

Verification:

- Request certificates of analysis from supplier
- Spot-check pH quarterly
- Document paper source in equipment register

INK SPECIFICATIONS

Mandatory: Pigment-Based Ink

Pigment vs Dye - Critical Distinction:

Dye-Based Ink:

- ☒ Water-soluble (fades with moisture exposure)
- ☒ UV-sensitive (fades in light within 5-10 years)
- ☒ Ballpoint pens typically dye-based
- ☒ Inkjet printers (consumer grade) typically dye-based

Pigment-Based Ink:

- ☑ Lightfast (UV-resistant, minimal fading over 100+ years)
- ☑ Water-resistant (survives moderate moisture)
- ☑ Archival grade available
- ☑ Permanent bond to paper fibers

Approved Writing Instruments:

Fountain Pens (Pigment Ink):

- Platinum Carbon Black (ultra-permanent)
- Sailor Kiwa-Guro (archival black)
- Noodler's Bulletproof Black (waterproof + fadeproof)

Gel Pens (Pigment Ink):

- Uni-ball Signo 207 (pigment-based, archival)
- Pilot G2 (NOT archival - dye-based, avoid)
- Sakura Pigma Micron (archival, technical drawing quality)

Ballpoint Pens (Rare Archival Options):

- Most ballpoint = dye-based (avoid)
- Fisher Space Pen with archival refill (acceptable)

Laser Printers (Carbon Toner):

Toner = Carbon-Based Pigment (Archival by Default)

- ☑ 200+ year permanence
- ☑ Water-resistant
- ☑ UV-stable
- ☑ Consistent density

Recommended:

- Any modern laser printer (Brother, HP LaserJet, Canon)
- Print settings: "Best" or "1200 DPI" for maximum carbon adhesion
- Avoid "Toner Save" mode (reduces permanence)

Verification:

- Test printout water resistance (droplet should bead, not smudge)
- UV test (expose to sunlight for 7 days, compare to unexposed sample)

Inkjet Printers (Caution):

Consumer inkjet = Dye-based (NOT archival) Archival inkjet requires:

- Epson EcoTank with pigment ink cartridges
- Canon PIXMA Pro series with Lucia pigment inks
- HP PageWide with pigment inks

Critical: Must use "pigment ink" cartridges specifically

- Cheaper "dye" cartridges will fade within 5-10 years

BINDING MECHANISMS

D-Ring Binders (Recommended)

Specifications:

- Ring diameter: 1.5" to 2" (accommodates 250-400 pages @ 160 GSM)
- Material: Vinyl or polypropylene (avoid PVC - off-gasses acids)
- Ring type: D-ring (pages lie flat, easier access than O-ring)

Advantages:

- ✓ Pages can be added/removed easily
- ✓ Annual updates don't require rebinding
- ✓ Clear spine pocket for labeling
- ✓ Available in archival-grade materials

Approved Brands:

- Wilson Jones Heavy-Duty D-Ring (polypropylene)
- Avery Durable Binder (acid-free materials)
- Samsill Clean Touch (antimicrobial, archival)

Three-Hole Punch Standards:

Hole spacing: 80mm center-to-center (ISO 838 / DIN 838)

- US standard: 4.25" (108mm) - incompatible, avoid
- European A4 standard: 80mm - use this

Hole diameter: 6mm Distance from edge: 12mm Equipment:

- Metal three-hole punch (plastic wears out)
- Alignment guide for consistent hole placement
- Maximum capacity: 20 sheets @ 160 GSM

Page Protectors (Optional but Recommended):

For high-turnover documents:

- Polypropylene page sleeves (archival-safe)
- Top-loading (easier insertion)
- Clear both sides (full visibility)

Use cases:

- P-01 (Access Register) - frequently referenced
- R-02 (Renewal Registry) - updated quarterly

Avoid:

- ✗ PVC page protectors (off-gasses, damages paper)
- ✗ Adhesive-backed sleeves (residue over time)

Alternative: Comb Binding (Not Recommended)

Why avoided:

- Cannot add pages without rebinding entire document
- Plastic comb degrades over 20-30 years
- Pages don't lie flat
- Less professional appearance

Alternative: Perfect Binding (Archives Only)

Use case: Final archive copies for L-VOL (Legacy Volume) production Specifications:

- PUR (Polyurethane Reactive) adhesive (archival grade)
- Sewn + glued spine (maximum durability)
- Archival-grade book cloth cover

Not suitable for working documents (cannot update)

STORAGE CONDITIONS

Temperature:

Ideal: 18-21°C (64-70°F)

- Maximum: 24°C (75°F)
- Minimum: 16°C (61°F)

Why temperature matters:

- High heat accelerates chemical degradation
- Freeze/thaw cycles damage paper fibers
- Stable temperature > exact temperature

Residential compliance:

- Store in climate-controlled room
- Avoid attics (extreme heat in summer)
- Avoid basements (potential moisture + cold)

Relative Humidity (RH):

Ideal: 35-45% RH

- Maximum: 50% RH (mold risk above this)
- Minimum: 30% RH (brittleness below this)

Why humidity matters:

- High RH: Mold, mildew, paper cockle (waviness)
- Low RH: Brittleness, static, ink flaking

Monitoring:

- Hygrometer in storage location
- Check monthly, log readings
- Use dehumidifier if consistently above 50%
- Use humidifier if consistently below 30%

Light Exposure:

Minimize UV and visible light exposure

- Direct sunlight: Fades ink within months
- Fluorescent lighting: UV component damages paper
- LED lighting: Lowest UV, preferred

Storage:

- Closed binders/cabinets (blocks light)
- UV-filtering window film if documents near windows
- Archive boxes for long-term storage

Air Quality:

Avoid pollutants:

- ☒ Smoke (tobacco, cooking)
- ☒ Off-gassing from new carpets, paints, furniture
- ☒ High dust environments

Mitigation:

- Air purifier with HEPA filter
- Sealed binders/boxes
- Acid-free tissue interleaving for critical documents

FIRE AND WATER PROTECTION

Fire-Rated Safes:

Minimum rating: 1 hour @ 1700°F (927°C) Standards:

- UL Class 350 (protects paper - won't exceed 350°F inside)
- ETL verified fire rating
- Impact resistant (survives building collapse)

Recommended brands:

- SentrySafe (consumer grade, adequate)
- FireKing (commercial grade, better)
- AMSEC (professional grade, best)

Size:

- Minimum: Letter/A4 size interior (14" W × 11" D × 6" H)
- Recommended: Accommodate 2-3 binders

Placement:

- Ground floor or basement (avoid upper floors - collapse risk)
- Secure to structure (bolt to floor or wall)
- Not visible from exterior windows

Waterproof Containers:

For flood-prone areas:

- Pelican cases (waterproof, crushproof)
- Aloksak bags (resealable waterproof bags, triple-layer)
- Dry bags (kayaking-grade, roll-top seal)

Nested protection:

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Outer: Fire-rated safe
Middle: Waterproof Pelican case
Inner: Aloksak bag with desiccant packet
Contents: Binder with P-Series instruments
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PROCUREMENT SUPPLIERS

Paper Suppliers (Archival Grade):

United Kingdom:

- Paperchase (archival products available)
- University Products UK (conservation supplier)
- Conservation by Design (professional archival supplier)

Online (International):

- Talas (talas-nyc.com) - conservation materials
- Gaylord Archival (gaylord.com) - archival supplies
- Hollinger Metal Edge (hollingermetaledge.com) - archival storage

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Quality Verification:

Upon receipt, verify:

- [ ] ISO 9706 certification present on packaging
- [ ] pH test confirms 7.0-8.5
- [ ] Thickness gauge: 160-200 GSM
- [ ] Infinity symbol (∞) present

Rejection criteria:

- pH below 7.0 (acidic)
- Weight below 160 GSM
- No archival certification
- Visible discoloration or defects

Document in procurement log:

- Supplier name
- Product code
- Batch number
- pH test results
- Date received

MAINTENANCE PROTOCOLS

Annual Document Review:

Physical Inspection:

- [ ] Check for yellowing, brittleness, discoloration
- [ ] Verify ink legibility (no fading)
- [ ] Inspect binding (rings intact, no cracks)
- [ ] Check storage conditions (temperature, RH logged)

Remediation:

- Replace degraded pages (reprint on fresh archival paper)
- Replace worn binders
- Update storage if conditions exceeded tolerances

Page Addition Protocol:

When adding new pages:

1. Use same paper stock as original (consistency)
2. Print with laser printer (archival toner)
3. Three-hole punch with alignment guide
4. Insert in chronological/categorical order
5. Update master registry (R-01) with addition date

Page replacement:

- Original damaged page → photograph for archive
- Reprint on archival stock
- Annotate in revision log
- Destroy original if sensitive

DIGITAL BACKUP STANDARDS

Philosophy: Paper primary, digital secondary Digital backups complement physical artifacts, not replace them.

Scanning Specifications:

Resolution: 300 DPI minimum

- 600 DPI for detailed documents (signatures, seals)
- Color scan even if original is B&W (preserves aging indicators)

Format: PDF/A (Archival PDF)

- PDF/A-1b or PDF/A-2b (ISO 19005 compliant)
- NOT standard PDF (proprietary features degrade)
- Embeds fonts, no external dependencies

OCR (Optical Character Recognition):

- Run OCR layer for text search ability
- Verify OCR accuracy (manual spot-check)
- Keep original image layer (don't rely on OCR alone)

Storage:

3-2-1 Backup Rule:

- 3 copies of each document
- 2 different media types (cloud + USB)
- 1 off-site location

Example Implementation:

1. Original paper in DP-02 (home safe)
2. PDF on encrypted cloud storage (DP-04)
3. USB drive in bank deposit box (DP-03)

MATERIAL DEGRADATION TIMELINE

Comparison of Materials:

Material	Longevity	Failure Mode
Archival paper (ISO 9706) + pigment ink	200-500 years	Eventual brittleness
Standard copy paper (80 GSM) + laser print	50-100 years	Yellowing, brittleness
Thermal paper (receipts)	5-10 years	Fading to blank
Dye-based inkjet print	5-15 years	Fading, color shift
Ballpoint pen (dye ink)	10-50 years	Fading, smudging
CD/DVD (consumer grade)	10-25 years	Bit rot, delamination
USB flash drive	5-10 years	Controller failure
Magnetic tape (LTO)	15-30 years	Tape degradation
Cloud storage (encrypted)	Unknown	Provider failure, format obsolescence

Conclusion: Archival paper + pigment ink = most durable long-term medium available

CASE STUDY - DOCUMENT FAILURE

X. CASE STUDY: DOCUMENT FAILURE Observed Failure (2021): Estate executor presented will drafted 1998, stored in standard manila folder. Condition:

- Paper: Standard copy paper (80 GSM)
- Ink: Blue ballpoint pen (dye-based)
- Storage: Solicitor's filing cabinet (uncontrolled environment)
- Age: 23 years

Degradation observed:

- Paper yellowed, brittle at edges
- Ink faded (barely legible in sections)
- Signature partially illegible
- Legal challenge raised due to authenticity concerns

Cost of failure:

- 18-month probate delay
- £45,000 legal fees for handwriting analysis + authentication
- Family dispute over legitimacy

Prevention:

- Archival paper (160 GSM, pH 7.5)
- Pigment ink (permanent)
- Climate-controlled storage
- Total additional cost: £15 for proper materials

Lesson: £15 materials investment prevents £45,000 litigation

IMPLEMENTATION CHECKLIST

For New P-Series Implementation:

Materials Procurement:

- [ ] Archival paper (160-200 GSM, ISO 9706, pH 7.0-8.5)
- [ ] Laser printer with fresh toner cartridge
- [ ] D-ring binders (1.5"-2", archival-grade)
- [ ] Three-hole punch (80mm spacing)
- [ ] Page protectors (polypropylene, optional)
- [ ] Fire-rated safe (1-hour @ 1700°F)

Quality Verification:

- [ ] pH test paper stock
- [ ] Print test page, verify ink permanence
- [ ] Test water resistance (laser toner)
- [ ] Measure GSM with thickness gauge
- [ ] Confirm ISO 9706 certification

Storage Setup:

- [ ] Hygrometer installed in storage location
- [ ] Temperature log established
- [ ] Fire safe secured to structure
- [ ] Light exposure minimized
- [ ] Air quality verified (no smoke, pollutants)

Maintenance Schedule:

- [ ] Annual physical inspection (calendar reminder)
- [ ] Quarterly climate log review
- [ ] Replace degraded materials as needed
- [ ] Update digital backups after changes

CONCLUSION

Material quality is not aesthetic preference. It is functional necessity. The P-Series instruments serve as continuity infrastructure during estate administration—often years after creation. Degraded documents create:

- Legal challenges (authenticity disputes)
- Execution delays (illegible information)
- Financial loss (re-creation costs, legal fees)

The Standard Index Group position: Institutional-grade materials cost marginally more than consumer-grade alternatives:

- Archival paper: £15/ream vs £5/ream (3× cost)
- Pigment ink pen: £3 vs £0.50 (6× cost)
- Fire-rated safe: £400 vs £150 (2.7× cost)

Total incremental cost for proper materials: ~£300 Cost of document failure in probate: £10,000-£100,000+ ROI: 30-300× The institutions that survive centuries—universities, museums, banks—don't use cheap materials. Neither should estates designed for multi-generational continuity. Physical permanence is not optional. It is foundational.

REFERENCES:

[1] ISO 9706:1994 - Information and documentation - Paper for documents - Requirements for permanence

[2] ISO 11108:1996 - Information and documentation - Archival paper - Requirements for permanence and durability

[3] ANSI/NISO Z39.48-1992 (R2002) - Permanence of Paper for Publications and Documents in Libraries and Archives

[4] ISO 14523:1999 - Photography - Processed films - Method for determining the curl of films

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FOOTER:

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END TN-04